

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
20 November 2003 (20.11.2003)

PCT

(10) International Publication Number
WO 03/096698 A1(51) International Patent Classification⁷: H04N 7/24 Joerg [DE/DE]; Fruerlunderbogen 11, 24943 Flensburg (DE).

(21) International Application Number: PCT/EP03/04876

(74) Agent: DINI, Roberto; Via Castagnole, 59, I-10060 None (IT).

(22) International Filing Date: 9 May 2003 (09.05.2003)

(25) Filing Language: English

(81) Designated States (national): JP, US.

(26) Publication Language: English

(84) Designated States (regional): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR).

(30) Priority Data:
02010591.2 10 May 2002 (10.05.2002) EP

(71) Applicant (for all designated States except US): MAYAH COMMUNICATIONS GMBH [DE/DE]; Am Soeldnermoos 17, 85399 Hallbergmoos (DE).

Published:

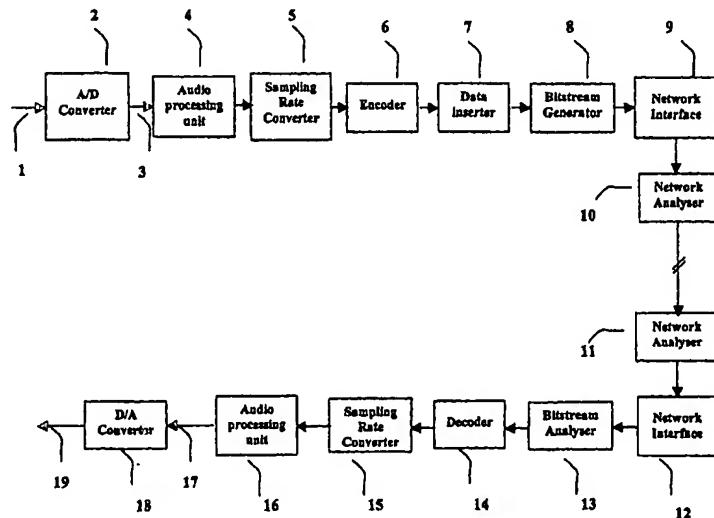
- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(72) Inventors; and

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(75) Inventors/Applicants (for US only): WIESE, Detlef [DE/DE]; Erlenweg 1A, 85354 Freising (DE). RIMKUS,

(54) Title: METHOD AND/OR SYSTEM FOR TRANSFERRING/ RECEIVING AUDIO AND/OR VIDEO SIGNALS AND MINIMIZING DELAY TIME OVER INTERNET NETWORKS AND RELATING APPARATUSES



WO 03/096698 A1

(57) Abstract: The present invention refers to a method and/or a system for transferring/ receiving audio and/or video signals and minimizing delay time over Internet networks comprising the steps of, on the transmitting side: converting, the input signal in digital form by means of an A/D converter; processing the signal in order to manipulate, control, adapt or change it; converting the sampling rate of the signal encoding the clock-adapted digital signal for multiplexing the encoded signal and packing it into a resulting multiplexed signal putting the multiplexed signal in a network; and analysing the active network interface as well as the opposite steps on the reception side whereby for reducing the delay time of the digital audio and/or video signal transfer, the IP packets generated are optimised by minimizing the packet size and low delay coding algorithm are chosen for encoding.

Method and/or system for transferring/receiving audio and/or video signals and minimizing delay time over Internet networks and relating apparatuses.

5. The present invention refers to a method and/or system for transferring audio and/or video signals and minimizing delay time over Internet networks.

It is known that Internet network is used for transferring several kinds of information among which also audio and/or video signals.

10. Today the transmission of audio as well as video signals via the Internet is known as being very slow, delayed and un-reliable.

15. E.g. web radio is not matching the quality of today broadcast listeners in FM or Digital Radio services. The overall delay in web radio some times can be higher than several seconds. Furthermore the audio quality is depending on the available network capacity. If too many users are using the Internet, the audio signal transfer may be interrupted.

Due to such results, professional audio and video broadcasting does not use IP (Internet Protocol) network for professional applications, in particular it avoids to use IP for live transmissions.

20. Aim of the present invention is to overcome the above described drawbacks and improving the quality of the transfer of audio and video signals over IP network by minimizing delay time and reducing the bandwidth requested.

For achieving such aims the present invention has as its object a method and apparatuses for transferring audio and/or video signals and minimizing delay time

over Internet networks, having the distinctive features described in claim 1 and further defined by sub-claims.

Further aims and advantages of said invention will result in being clearer from the detailed description that follows and annexed drawing supplied as an explicative and non-limiting example.

Only for practical reasons, the example described refers to a method of transmission and reception of audio signals over Internet Protocol networks but the same principles are applicable also to video signals.

Figure 1 represents a block diagram of a transmission and receiving system of audio signals according to the invention.

The system consists of the following parts which may be set in sequence or in another order to define certain applications, where,

on transmitting side:

- With number 1 is indicated an analog audio input signal, mono or stereo;
- With 2 is indicated an A/D converter converting the analog signal into a digital signal when analog inputs are used;
- With 3 is indicated a digital audio input signal, mono or stereo or multi-channel 5.1, or 7.1 or similar, which is the result of the A/D conversion or a direct digital input; when digital inputs are used the A/D converter 2 is not used;
- With 4 is indicated an audio processing unit able to manipulate, control, adapt or change the digital audio signal;
- With 5 is indicated a sampling rate converter needed for adapting the digital input clock to the network clock or for adapting the A/D clock to the network clock resulting in an clock-adapted digital signal;
- With 6 is indicated an Encoder(s) to encode the digital signal, for instance, into a linear, perceptual-coded or non-perceptual-coded format for reducing the number of bits resulting in a lower bit rate encoded signal; the choice of the coding algorithm and the setting of some parameters, such as frame length, bit rate and sampling rate, etc., is performed with the aim to reduce the delay time of the transmission over IP networks;
- With 7 is indicated a data inserter which may be used to insert additional data, either within the encoded signal or in a separated stream; alternatively the data inserter may be used to replace less significant bits of the encoded signal with

such additional data (i.e. in the way described in German patent application DE 44 30.864);

With 8 is indicated a bitstream generator to multiplex the encoded signals and/or data signals and/or the hidden data signals and to pack them into a resulting multiplexed signal which needs to comply with the used and/or applied network interface; the obtained packet data shall be opportunely sized so that the delay time in the transmission is reduced;

- With 9 is indicated a network interface which puts the multiplexed signals in the network;

10. - With 10 is indicated a network analyser which analyses the active network interface or verifies which network interface is receiving and/or sending data; on receiving side:

- With 11 is indicated a network analyser which analyses the active network interface or verifies which network interface is receiving and/or sending data;

15. - With 12 is indicated a network interface which takes the multiplexed signal from the network and provides it to a bitstream analyser 13;

With 13 is indicated the bitstream analyser which analyses the multiplexed signal in order to de-multiplex the signal for obtaining an encoded signal;

20. - With 14 is indicated a Decoder(s) to decode the encoded signal into a digital signal; said decoder shall be able to decode the same coding scheme used in the transmitting side, for instance a linear, perceptual-coded or non-perceptual-coded format;

25. - With 15 is indicated a sampling rate converter needed for adapting the network clock to the digital output clock or to adapt the network clock to the D/A converter clock and resulting in a clock-adapted digital signal;

- With 16 is indicated an audio processing unit able to manipulate, control, adapt or change the digital audio signal;

- With 17 is indicated a digital audio output signal, mono or stereo or multi-channel 5.1, or 7.1 or similar, which results the replica of the digital audio input signal 3;

With 18 is indicated a D/A converter converting the digital audio signal into a analog audio signal;

- With 19 is indicated an analog audio output signal, mono or stereo, which results the replica of the analog audio input signal 1.

The characteristics of the described methods, object of the present invention, result clear from the present description and annexed drawing.

The advantages of the method object of the present invention also become clearer from the description.

They consist in the fact that from the encoding part of the system the encoded signal and/or data signal and/or the hidden data signal are packed by the bitstream generator into IP datagrams, which constitute the above said multiplexed signal encoded with the aim to reduce the delay time of the transmission over IP networks. An IP datagram always includes an header, with synchronization, delivering and system information, which represents an overhead. Said overhead being higher when more-significant short packets are used or transmitted and being lower when less-significant longer packets are used or transmitted.

In particular, the IP packet generated by the bitstream generator 8 is optimised by minimizing the packet size for the TCP (transfer control protocol) or UDP (user datagram protocol) packages.

Further advantages are represented by determined choices carried out inside the encoder 6. For instance, low delay coding algorithm may be chosen or other parameters may be set with the aim to reduce the delay time, namely a small frame length, an high bit rate and an high sampling rate.

Such parameter setting allows the user to control the coding delay time versus quality and bit rate and similar parameters and can include an automatic calculation to reach lowest delay or lowest bandwidth. This is considered to be a great benefit.

The same situation is obtained in the receiving part of the system with the use of devices that are mirroring the encoding/transmitting part.

It also clear that numerous variants can be supplied by the skilled man to the method and/or system for transferring/receiving audio and/or video signals and minimizing delay time over Internet networks and relating apparatuses described as an example, without however departing from the novelty principles inherent in the present invention.

CLAIMS

1) Method for transferring/receiving audio and/or video signals and minimizing delay time over Internet networks comprising the steps of:

On the transmitting side:

- Converting, if available in analog form, audio and/or video input signal in digital form by means of an A/D converter;
- processing the digital audio and/or video signal in order to manipulate, control, adapt or change it;
- converting the sampling rate of the digital audio and/or video signal for adapting the digital input clock to the network clock or for adapting the A/D clock to the network clock resulting in an clock-adapted digital signal;
- encoding the clock-adapted digital signal for reducing the number of bits resulting in a lower bit rate encoded signal;
- multiplexing the encoded signal and packing it into a resulting multiplexed signal which needs to comply with the used and/or applied network interface;
- putting the multiplexed signal in a network;
- analysing the active network interface or verifies which network interface is receiving and/or sending data;

on the reception side:

- analysing the active network interface or verifying which network interface is receiving and/or sending data;
- taking the multiplexed signal from the network and providing it to a bitstream analyser (13);
- analysing the multiplexed signal in order to de-multiplex the signal for obtaining an encoded signal;
- decoding the encoded signal into a digital audio and/or video signal;
- converting the sampling rate of the digital audio and/or video signal for adapting the network clock to the digital output clock or to adapt the network clock to the D/A converter clock and resulting in a clock-adapted digital signal;
- processing the clock-adapted digital signal to manipulate, control, adapt or change it;

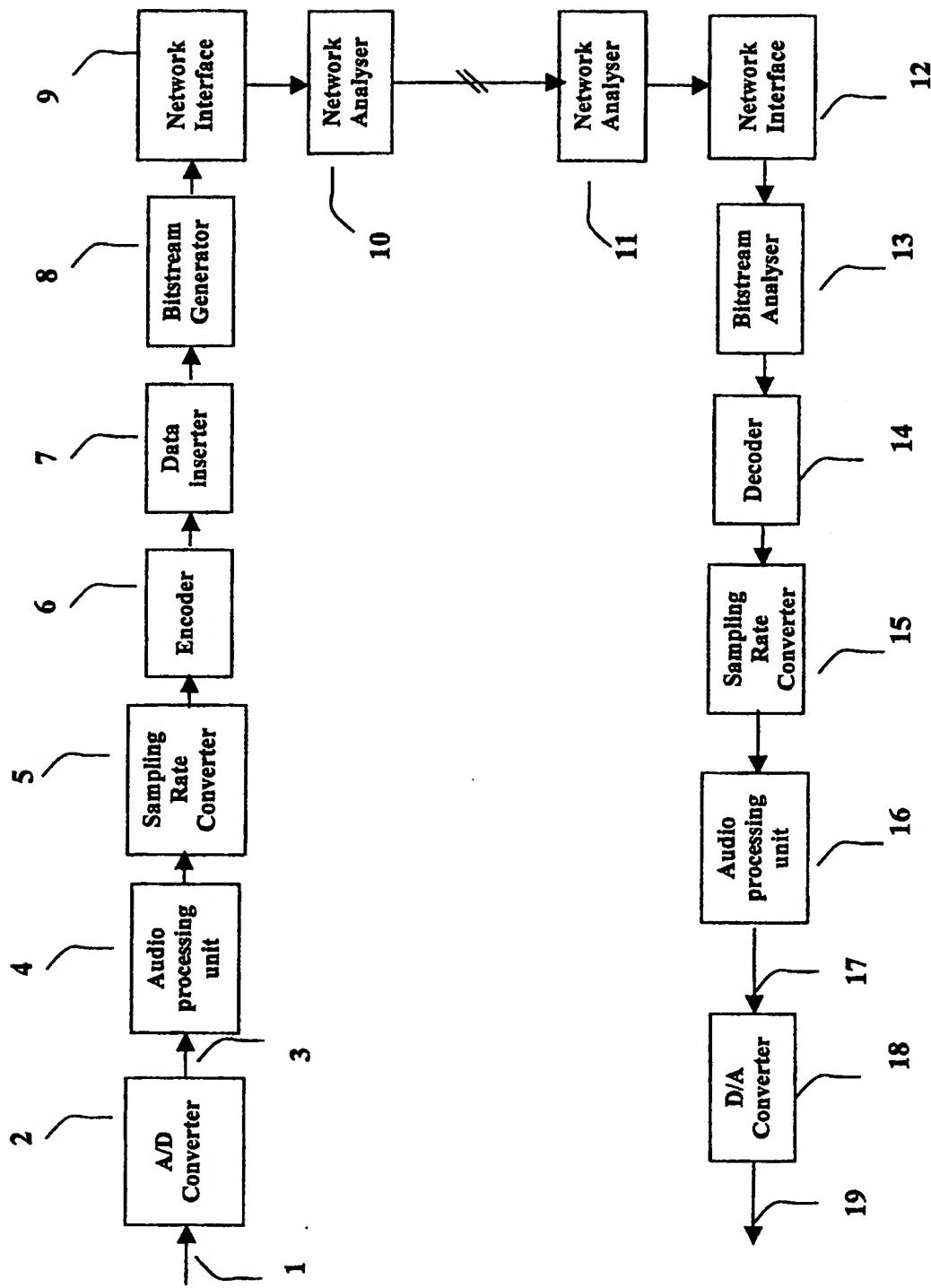
- converting in analog form the digital audio and/or video signal by means of an D/A converter;

characterised in that, for reducing the delay time of the digital audio and/or video signal transfer, the IP packets generated by bitstream generating means

5 (8) are optimised by minimizing the packet size and low delay coding algorithm are chosen by encoding means (6).

- 2) Method for transferring/receiving audio and/or video signals according to claim 1, characterised in that a data inserter (7) is used to insert additional data, either within the encoded signal or in a separated stream, or, alternatively, 10 used to replace less significant bits of the encoded signal with such additional data;
- 3) Apparatus for the transmission of audio and/or video signals and minimizing delay time over Internet networks implementing the method as defined in one or more of the preceding claims.
- 15 4) Apparatus for the reception of audio and/or video signals and minimizing delay time over Internet networks implementing the method as defined in one or more of the preceding claims.
- 5) System for transferring/receiving audio and/or video signals and minimizing delay time over Internet networks implementing the method as defined in one or more of the preceding claims.
- 20 6) Encoded signal according to claims 1 or 2 characterised in that is obtained by a low delay coding algorithm and that is coded with a small frame length, an high bit rate and an high sampling rate.
- 7) Multiplexed signal according to claims 1 or 2 characterised in that the IP packet 25 has the minimum packet size.
- 8) Decoded signal according to claims 1 or 2 characterised in that is obtained by decoding a low delay algorithm and a small frame length, an high bit rate and an high sampling rate.
- 9) Demultiplexed signal according to claim 1 or 2 characterised in that the IP 30 packet has the minimum packet size.

FIGURE 1



A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04N7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 320 588 B1 (PALMER LARRY G ET AL) 20 November 2001 (2001-11-20) column 5, line 35 -column 7, line 49 column 10, line 20 -column 10, line 47 column 12, line 66 -column 14, line 21 figures 2,6 ---	1,3-5,7, 9
Y	column 5, line 35 -column 7, line 49 column 10, line 20 -column 10, line 47 column 12, line 66 -column 14, line 21 figures 2,6	2
A	US 6 154 780 A (ZHU CHUNRONG) 28 November 2000 (2000-11-28) abstract column 6, line 10 -column 6, line 34 column 7, line 53 -column 9, line 22 figures 5,7 ---	1,3-5,7, 9

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- °A° document defining the general state of the art which is not considered to be of particular relevance
- °E° earlier document but published on or after the international filing date
- °L° document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- °O° document referring to an oral disclosure, use, exhibition or other means
- °P° document published prior to the international filing date but later than the priority date claimed

- °T° later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- °X° document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- °Y° document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- °&° document member of the same patent family

Date of the actual completion of the international search

4 September 2003

Date of mailing of the international search report

15/09/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl
Fax: (+31-70) 340-3016

Authorized officer

Hampson, F

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 44 30 864 A (CORPORATE COMPUTER SYSTEMS EUR) 7 March 1996 (1996-03-07) cited in the application abstract column 3, line 66 -column 4, line 31 ---	1,3-5,7,9
Y		2
A	"ITU-T, H.323, PACKET BASED MULTIMEDIA COMMUNICATIONSSYSTEMS" ITU-T H.323, XX, XX, September 1999 (1999-09), pages 1-129, XP002166480 ---	
A	"G.728" 14 October 2002 (2002-10-14) , AVAILABLE FROM INTERNET <WWW.ITTIA.M.COM/PAGES/PRODUCTS/G728.HTM> XP002216730 the whole document -----	

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 6320588	B1	20-11-2001	US	5623690 A	22-04-1997	
			US	5375068 A	20-12-1994	
			US	6577324 B1	10-06-2003	
			US	5546324 A	13-08-1996	
			US	5594495 A	14-01-1997	
			US	5608653 A	04-03-1997	
			US	5831666 A	03-11-1998	
			US	6195683 B1	27-02-2001	
			US	5475421 A	12-12-1995	
			US	5594859 A	14-01-1997	
US 6154780	A	28-11-2000	NONE			
DE 4430864	A	07-03-1996	DE	4430864 A1	07-03-1996	